Ohio State Engineer

Center of World-Reaching Exposition . . . The central figure on the facade is rising above the towers of Manhattan . . . She lifts the veil that has obscured the world of tomorrow . . . Her gesture is one of welcome . . .

ENGINEERING FOR N. Y. WORLD'S FAIR

By ROBERT DERRENBERGER

Editor's Note: First of a series of articles to appear.

IT goes almost without mentioning that the New York World's Fair of 1939 will stand as a splendid summary of all that the many sciences have achieved to date, as well as a vision of what may be accomplished in the future. The exposition's perfection, indeed, will tend to cover the whole process of construction; therefore it will not be as obvious that those entrusted with creating the "big show" were from the start scientifically minded in approaching the many problems of a $150,000,000 masterpiece display. The fair must be the equivalent of a great, new and spectacular city of 800,000 population and brought into being, of a necessity, in about two and one-half years; but it is not to be jerry-built as have so many expositions. Its every step in construction has been marked by that digging for facts that characterizes a scientific approach.

In the matter of providing a 1216½ acre site close to the heart of New York City, "digging" was something more than research work in some library. It meant the moving of almost 7,000,000 cubic yards of ash fill and meadow mat—after borings had been made to sample every yard of a salt marsh down to at least 100 feet below final grade.

The site for the fair, less than eighteen months ago, was in one part an impenetrable swamp and in the other part a heap of 50,000,000 cubic yards of ashes resting on unstable swampland. Where private interests of individuals had made small fills, these had speedily proved unsatisfactory—if they hadn't actually slid off sidewise into the swamp. The area was considered "bottomless," as was of course not the case. It couldn't ever be made stable enough for a World's Fair, which was only a statement by those reckoning without the thoroughness of the scientifically-minded engineers.

These same engineers started digging, or boring. They stopped only when they knew the 1216½ acres "from the ground" down through swamp mat or ashes to 10 feet or 50 feet of wet silt, and on down to a reliable bearing stratum of fine sand and clay. Their work was so thorough that in the end they could tell other engineers the exact composition of "soil" at any point of the entire site down to 100 feet below grade. When this had been done, New York City proceeded to let a $2,200,000 contract for preparation of its fair site. The science of soil mechanics had determined the manner in which to handle the tidal swamp.

Flushing Meadow, as the site of the fair is now called, is in reality a crust of ash-fill afloat on a baylike area of wet silt. Instability, however, is gone. There will be no more sidewise slipping of buildings properly erected according to specifications for the ground; the engineers are content about that.

The science of soil mechanics, however, did not stop with enlightenment about the laying on of ashes. Such fill would grow little more than a scrawny weed, whereas shrubbery, lavish arrays of flower beds and fine sod, to say nothing of 10,000 trees, figured in plans for beautifying the fair grounds beyond all precedents set by exposition history. Topsoil, and plenty of it, would be needed. Sufficient study disclosed the feasibility of creating such soil out of meadow mat excavated in preparing the beds of the fair's two large lakes.

In trial plots of this material grass is being grown. The saving represented by this spot manufacture of soil from material that otherwise would have to be carted away or towed out to sea is set at $500,000. Commercial topsoil required for the fair would denude some 500 acres of arable ground.

Tidal salt waters no longer enter the lagoon regions of the exposition site, for tidal control gates, costing $586,361, now permit maintenance of fresh water levels and shore plantings of vegetation.

Under the circumstances attending construction of the site, the Fair Corporation's engineers can scarcely be considered "daring" in their designing of such heavy structures as the Theme Centre wonders, the 700-foot Trylon or triangular needle and the 200-foot Perisphere or steel-framed globe that will house the exposition's masterpiece display. Rather are the engineers ingenious and understanding of the conditions with which they work. (A more detailed description of the architectural features will be included in the next issue.)

Contractors have just completed the monumental masses of concrete and steel that will support the Perisphere and Trylon. The former's weight of almost ten million pounds will be stabilized by 548 of the Northwest's finest pilings of 90-odd feet length. Beneath the Trylon's foundations are 597 of the same lot of tree trunks. All pilings have been creosote treated for permanency's sake. The sticks were driven from towering booms by steam hammers capable of delivering 15,000-pound blows. On the average the piles went down to 100 feet below grade level, through about 40 feet of ash fill and 50 feet of wet silt to the bearing stratum of sand and clay. Once the pile tips reached the sand-clay "going," as many as one hundred of the mighty hammer blows were required to drive an inch of timber.

Trylon and Perisphere—the Theme Structures

The Perisphere pilings now bear a concrete cap or ring wall, 14 feet wide in the ring and approximately 10 feet deep. The Trylon pilings bear three octagonal caps, with 63-foot bearing beam, having an overall depth of more than 12 feet. On these colossal underground monuments to scientific understanding and on the labors of many men, contractors during the winter will erect the intricate steel framework of the Theme Centre structures.

Long ago now, Grover A. Whalen, as president and spokesman of the Fair Corporation, promised that the exposition would remove scientific experiments from the laboratory shelves and place them in practical operation for the entertainment and instruction of the 50,000,000 persons for whom the exhibition is being built. A striking instance of the manner in which this promise is being fulfilled is the development of illumination principles and equipment.

The simple little fact that the tiny veins on the under side of living tree leaves fluoresce when exposed to mercury vapor light rays, gave to illumination engineers the basis of their plan for unique lighting of the magnificent Central Mall and Theme Centre plazas of the 1929 fair. The feature of the plan is illumination by reflection of mercury vapor light rays from the stately trees of the broad avenues paralleling the fountain and sculpture-studded pools of the splendid esplanade. Each and every tree of the hundreds already transplanted to the area will be flooded with light from a mercury lamp installed out of sight in the ground and projecting a vertical beam into the foliage. The resultant effect will be that of a greenish-white luminescence.

The beams of light emerging from the ground will have the appearance of fountains. Miniature lights also have been devised for concealment in the ground of flower beds, where the natural colors of tens of thousands of brilliant blooms will be brought out in strong contrast to the illuminated tree foliage. Further brilliant contrasts will be afforded by reflection effects from the massive and colorful exhibit halls flanking the Central Mall and its plazas. Experiments show that this type of illumination will provide an unusual, restful atmosphere, entirely free from the garish effects commonly associated with exposition lighting, and at the same time reveal the spaciousness of the mall and bring out the beauties of its fountains, sculptures, flowers and buildings.

Mercury vapor lamps have been especially developed for this unique type of illumination. To carry out the plan will mean that the mall and plazas will be entirely free of lighting poles and lamp standards. The lighting units under trees and in flower beds will be invisible both by day and by night. The necessary equipment design has been perfected through experiments at night under actual conditions prevailing at the site and with a number of the very trees that will figure in the novel lighting. It is stated at Fair headquarters that this illumination plan will establish a long line of precedents, both in the matter of beautiful and effective lighting and in economies of installation and operation.

The Fair among its laboratories of sorts maintains a unique "test building" that is seldom of the same shape and color for more than a few days at a time,

and that can be made to twist, heave, buckle, sag or otherwise contort—all at the will of designers and engineers. The structure is further evidence of the extent to which the corporation must go in providing new wonders and safe, attractive buildings for the outstanding planned event of 1939. It comprises a set of walls, of exhibit building height, upon which to try out the merits of various types of wall coating and different stucco treatments.

Ground consolidation, wind pressure, fire resistance, stucco layering, weather tightness, stud spacing, paint acceptance, insulation against change in temperature, light refraction, illumination possibilities, ceiling heights, flexibility of materials, facade contours, and economies consistent with temporary structures; these are a few of the factors governing research as carried on within and without the test building.

The durability, appearance and structural peculiarities of walls are of great importance to the fair corporation, since the estimated 300 buildings of the exposition will require somewhere around 15,000,000 square feet of such enclosures.

A box-like structure, 60 feet by 40 feet on the ground, with a sawed-off tower and a doorway involving columns at one end, the odd laboratory building stands today a conglomeration of color and material that is saving money for the Fair and making for the security of exposition visitors. Its walls comprise 43 different set-ups of material, supporting back material, and surface coating. Its flexibility comes from a latticework of adjustable steel bracings and easily controlled foundation shims. An array of imposing exhibit halls is already appearing on the fair grounds, but the test building will not have completed its cycle for months to come. When its day is done, it can be wrecked in a jiffy—simply by knocking out the shims under its pillar foundations.

Meanwhile, the Fair's illumination engineers also conduct experiments on the inside and outside of the building. Miscellaneous equipment on the roof has been set up by radio or sound amplification engineers, whose concern is "beam broadcasting" apparatus of new design and power. Should these last attain their objective the exposition will see the inauguration of broadcasting so accurate that one could talk directly to a visitor on one end of a park bench without even attracting the attention of a person on the other end of the bench.

Some $10,000,000 worth of imperative improvements are "disappearing" in their proper places below ground over the site of the fair. At the end of 1937, work was in progress on contracts, commitments and purchase orders mounting close to another $10,000,000 total—exclusive of the many millions of dollars being expended by city and state on collateral improvements already made or in progress for the 1939 event. Already enrolled for the fair, as of December 1, are: 32 states and 2 territories, 55 foreign nations, and 161 American corporations or other prominent establishments. An unprecedented number of these will be erecting their own exhibit buildings—to the extent of new highs and unbeatable records in participation—while all will institute displays of new character.

While it is true, then, that even at this comparatively early date the grounds show the pattern of the $150,000,000 fair, it is still far too early to estimate the number or character of new products and wonders to be brought forth for the event by scientifically directed endeavor. The best that can be done at the moment is an indication of the manner in which science and invention will come to the exposition.

Airport Antenna Reduces Static

Following months of laboratory tests, air-line engineers recently announced the development of an antistatic loop antenna for use by ground radio stations. Resembling a large hoop, the new antenna is five and a half feet in diameter. The loop casing is made of aluminum, while the antenna itself consists of a single strand of copper wire supported within the loop by a series of porcelain beads. The loop antenna is set up outdoors.

Student Takes Photographs of Bullets in Flight

Using only a conventional camera fitted with an F/4.5 lens, Francis B. Riggs, Jr., a young Harvard University student, photographs bullets in flight by employing an ingenious flash apparatus that he made from old automobile parts, odd materials from discarded radio sets, and pieces salvaged from an old razor. For one of his spectacular stunts, a .44 caliber revolver held in a fixed mount is trained on an electric lamp set in the center of the table. Between the lamp bulb and the gun muzzle, Riggs stretches a copper wire, which, when snapped by the bullet, sets off the homemade apparatus to flash a brilliant light that lasts for about one-millionth of a second, "stopping" the projectile as it enters the bulb. The photographing is done in a darkened room.

Huge Streamline Ships To Cut Time For Ocean Crossings

Slicing through the water at 37 knots, a streamline ocean liner proposed by French ship owners would cut down the time of a transatlantic passage to three and a half days. Plans call for a vessel more than 100 feet longer than the height of the tallest skyscraper, and more than 300 feet longer than the largest vessel afloat. The concealment of funnels is an outstanding feature. Sliding glass roofs will cover the upper decks of the ship.